Status of

LAr OO Reconstruction

S. Rajagopalan

(H. Ma, S. Qian, J. Schwindling)

ATLAS Software Week

May 12, 2000

The PASO Effort

- NEW OO design and implementation
- Three major “packages”:
  - **Cell Reconstruction**
  - **Cluster Reconstruction**
  - **Analysis**
- Emphasis on separation between “algorithm” and “data” objects.
- Framework like qualities to manage the creation and management of algorithm & data objects (since no such services are available in paso)
- Tested for Barrel/Endcap calorimeters only
  - **generic design & should be extensible to other calorimeters.**
- Performance Studies
- Not all use-cases implemented.

PASO Effort (2)

- Cell Reconstruction:
  - **Use of 'RD Event Model' to read in Geant3 calorimeter digits**
  - **Creation of calibrated Cell Objects from digits**
  - **Sampling weights**

- Cluster Reconstruction:
  - **Implemented the Sliding Window Algorithm as in ATRECON**
  - **Other Algorithms being implemented**
  - **Energy & Position Corrections:**
    - Out of cone, Eta/Phi modulations, Crack corrections, S-Shape

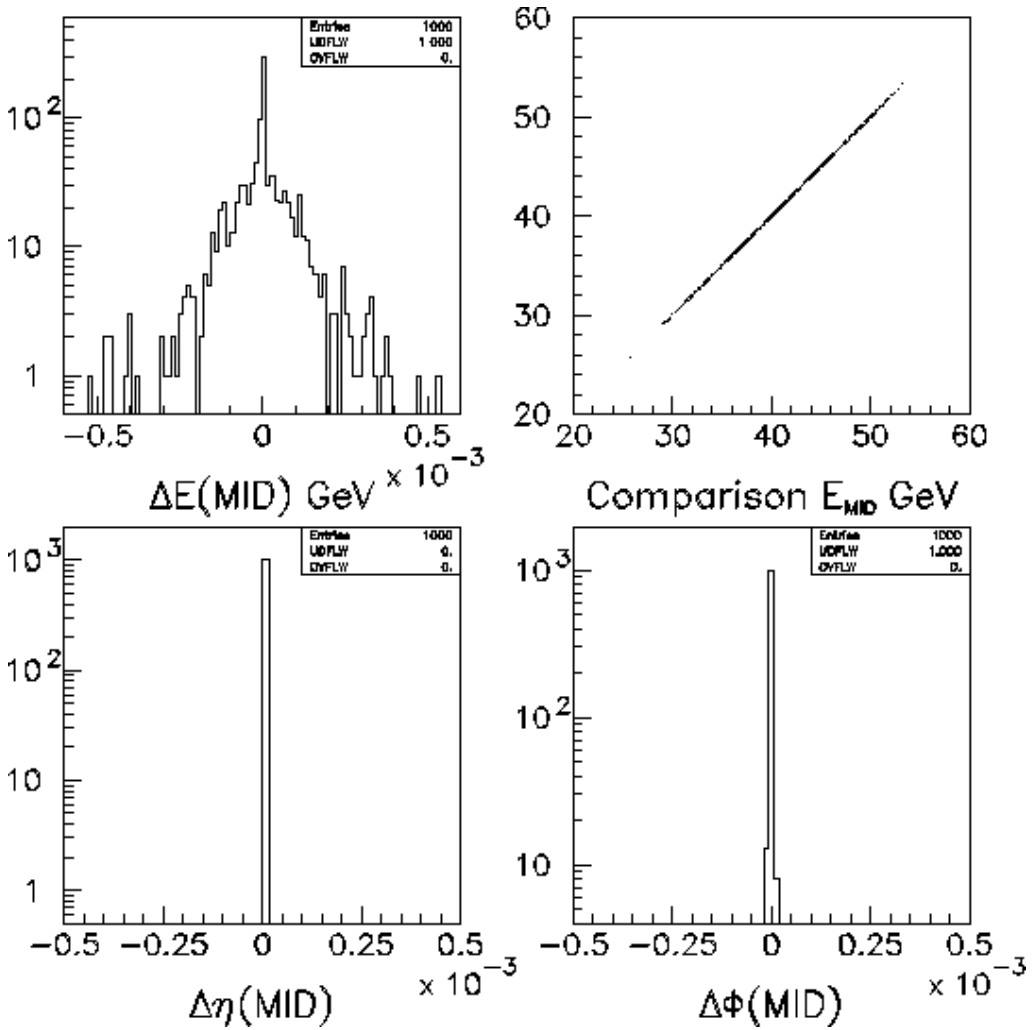
PASO Effort (3)

- Analysis Program
  - **Wrapped Fortran code to generate standard PAW ntuples**
  - **Use of HTL to print/dump histograms and write into Objectivity**

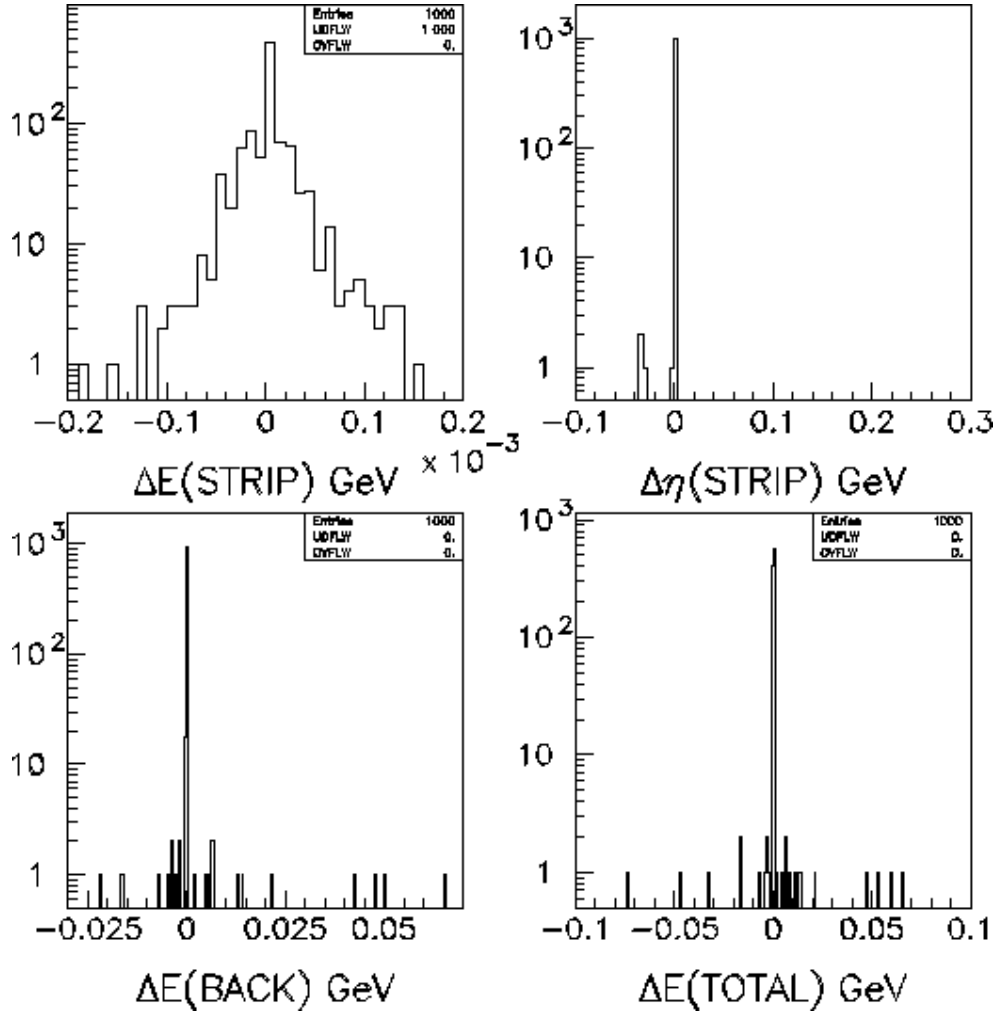
- Code available now in CVS repository:
  - **offline/LArCalorimeter/LArRec/LArPaso**
  - **NOT tagged**

- Testing
  - **Data Sample: single particles (fixed E, η), H --> $\gamma\gamma$**
  - **Extensive comparison with ATRECON**
  - **Results look very good**

Comparisons (1)



Comparison (2)



Timing Studies

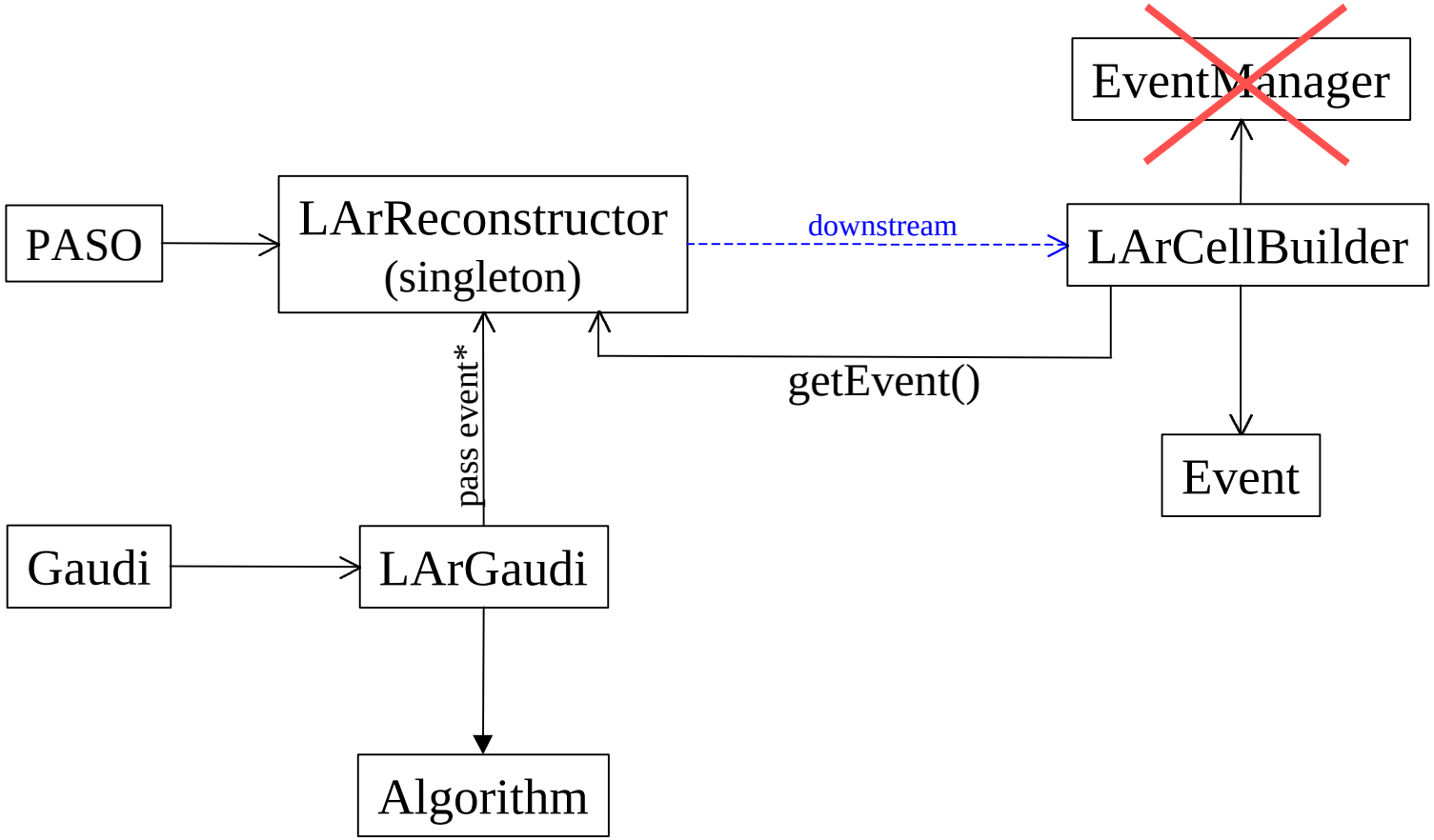
- Preliminary timing studies on HP using single photons (from Jerome):

(in seconds)	ATRECON	PASO
Initialization	3.1	2.7
Cell Unpacking + Calibration	0.23	0.12
Combined Matrix + Clustering	0.43	0.27
Cluster Analysis	0.02	0.07
TOTAL (per event)	0.68	0.46

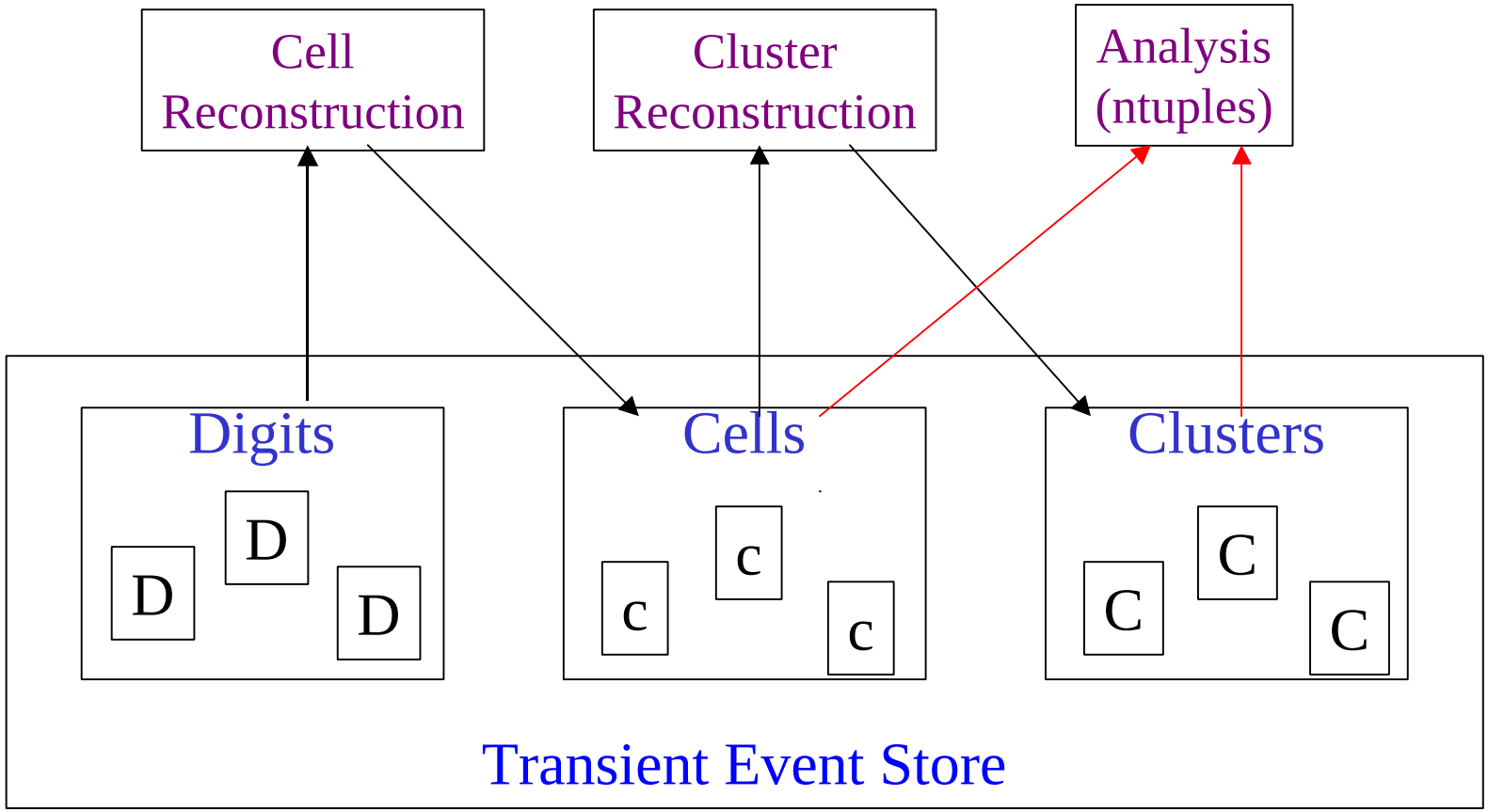
The new Framework

- We have successfully integrated with the new “Gaudi” framework.
  - **Four days at Berkeley (April 4 - 7)** (H. Ma, SR, T. Wenaus)
- We reported on our experience at the last Architecture workshop **(4/17)**
- The goal was to take a working PASO code and make it functional under the new framework. No attempt to optimize the design to match our requirements.
- The LAr component was a part of the tutorial. Hopefully helpful! The tutorial will be documented and released to allow others to go through the exercise as well.

Wrapping your code in 'Gaudi'



L A r R e c . i n “ G a u d i ”



Cell Reconstruction in "Gaudi"

- **CellMaker :** A "Gaudi" algorithm that packages together a desired set of CellBuilders and CellCorrections.
- Declare CellBuilders/Corrections as Properties (jobOptions.txt).
- Instantiate them as sub-algorithms in CellMaker and execute.
- CellBuilder **'finds'** the event in the transient store to access calorimeter digits.
- Generate an ObjectVector (container class) and register in the transient event store.
- CellBuilder generates LArCell objects : declared as ContainedObjects.
- CellCorrections modify the created objects in transient store.
- Extensive use of Property and Message Service Features.

Clustering/Ntuples in "Gaudi"

- Adopt the same strategy for the Clustering
  - **ClusterBuilder and ClusterCorrections declared as sub-algorithms**
- ClusterBuilder 'finds' the CellContainer from the transient store
- Perform clustering and create LArCluster Objects (contained objects)
- Register clusters in the transient store

- Histogramming Service:
  - **Successfully incorporated the Gaudi ntuple service and got rid of the wrapped fortran ntuples**
  - **Retrieval of quantities to ntuple from the transient store**

- We successfully tested the entire chain by the end of Day 3 at LBL : from reading Geant3 TDR data to generating standard paw-ntuples.

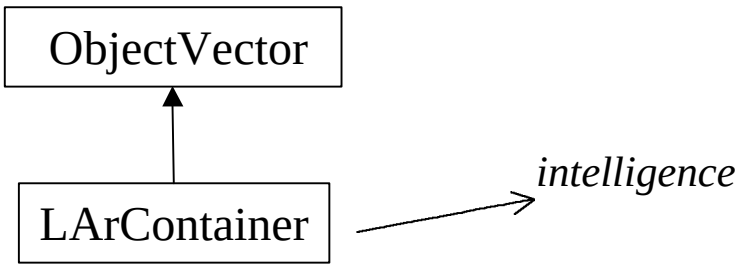
Comments

- The integration effort went very smoothly
  - **Defining data and algorithm objects in PASO helped**
  - **Excellent help from Charles, Craig, David, Paolo**
- The framework like components we had in PASO diasappeared or were replaced.
- How much did we have to change:
  - **Algorithms/Sub-Algorithms/DataObjects ~ 10 lines**
  - **Private Algorithms : no changes**
  - **Ntuples: Completely modified to use Gaudi Services**
  - Added features that were not otherwise available : run time specification

- Several comments on the integration effort which we discussed these during the Architecture Workshop

Containers

- Collections in PASO maintained by “manager” classes with some limited intelligence:
  - **Given an identifier, return pointer to the corresponding cell object**
- Use of ObjectList and ObjectVector in Gaudi.
  - **No desired intelligence. Get around this by:**



- Need an ObjectMap

Dependency on "strings"

jobOptions.txt:

```
ApplicationMgr.TopAlg("Cell/c1", "Cell/c2", "Cluster/Z")
c1.container = "bob"
c2.container = "bill"
z.needcontainer = "bob"
```

Class Cell:

initialize():	declareProperty("container", _string)
execute():	registerObject(ptr, _string)

Class Cluster:

initialize():	declareProperty("needcontainer", _string)
execute():	retrieveObject(_string, ptr)

Access to Transient Store

- Heavy dependency on strings
- Chances of making mistakes (typogarphical?) are high.
- jobOptions file becomes too long and unmanageable

- Access by types + some use of selection methods highly desirable.
  - **Store LArCellContainer by its type and "keys" that you can select on.**
  - **Clustering algorithm finds objects of type LArCellContainer and specifying a selection criteria.**
  - **Should be able to browse the store for all instances of LArCellContainer**
- Modifications to transient event store. Should this be allowed?

Communication between algorithms?

- What is in the transient store?
  - **Persistable Objects**
  - **Objects required for commnication between packages**
- We allow some localized communication between algorithms that are not “Gaudi algorithms” (do not inherit from Algorithm). We however restrict this communication to algorithms within a package.

But :

- Gaudi requires you to be an “algorithm” or a “sub-algorithm” to communicate to the transient event store.
- The use of “Property” and “Message” services is also currently limited to these algorithms and sub-algorithms.

Few other details

- Need a SetProperty that accepts non-atomic types…
  - **sub_algorithm->setProperty(Identifier)**

- Using SmartPointers : Remember to dereference them!

```
SmartDataPtr<Event>   m_event(eventDataService(),"/Event");
if (m_event)
        SmartDataPtr<LArContainer>   cell(m_event,m_string);
```

- Compatibility with PASO or running in some simplified mode?
  - **Should not be excessive overhead to do something simple.**

Conclusion

- Integration with Gaudi went very smoothly : 3 composite algorithms
- Complete testing (including timing/memory issues)
- Need to work with other efforts:
  - **FCAL and HEC**
  - **Tile Calorimeter**
  - **Test Beam**
- Incorporating other features in ATRECON:
  - **Pile up, noise**
  - **Optimization of algorithms**
- Documentation : See LAr Software Page --> Reconstruction
- Need more feedback: Other Users? Reviews?